

Physics

DEVELOPMENT OF AN ELECTRON BEAM TRANSMISSION WINDOW FOR USE IN A KrF LASER FOR INERTIAL FUSION ENERGY

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A silicon (Si) based electron beam transmission window is to be produced for use in a KrF laser system in support of inertial fusion energy technology. Silicon is the material of choice because of its low Z value and high structural integrity. The window separates the lasing medium from an electron beam source while allowing the electron beam to pass through. The window must meet certain requirements set by the characteristics of the laser and must be able to withstand the hostile environment presented by the lasing medium and electron beam source. This environment includes KrF gas, ≥ 1500 gauss magnetic fields, large exposure to x-rays, and a ΔP of 2 atm. Materials, structures, and cooling systems for the window are determined theoretically based on the requirements of the system. Empirical tests for the window are set up to simulate the actual environment it will operate in. Results of these empirical tests are discussed. Various design changes are considered to enhance the structural integrity of the Si windows and relieve stresses at the edges due to thermal expansion. This work is supported by the Naval Research Laboratory (NRL) in collaboration with the Princeton Plasma Physics Laboratory (PPPL).